

Sedimentary Characteristics and Controlling Factors of a Tight Sandstone Reservoir in the Upper Triassic Yanchang Formation, Southwest Ordos Basin, China

Yi Gao¹, Zaixing Jiang¹, and Xiangxin Kong¹

¹College of Energy Resources, China University of Geosciences, Beijing, China.

ABSTRACT

Ordos Basin is the second largest and the most productive oil- and gas-bearing basin in China. The Ch81 interval of the Upper Triassic Yanchang Formation is an important targeted reservoir in this basin. This tight sandstone reservoir is famous for its ultra-low permeability and high-production wells under water fracturing. For a long time, sandstones in this interval are interpreted to be deposited in a shallow water braided delta sedimentary system in the southwest of the basin. The thick-bedded channelized sandstones are well-connected vertically and laterally, and the reservoir quality is determined mainly by fault development condition. In this research, based mainly on core observation, description and analysis, we proposed that sediment gravity flow deposits are well-developed in the study area in the southwestern Ordos Basin. There are four basic lithofacies assemblages: (1) thick-bedded sandstone with abundant lamination structures as channelized sandy deposits in braided delta; (2) thick-bedded chaotically contorted sandstone as sandy slump; (3) thick-bedded structureless sandstone as sandy debrite or high-density turbidite; (4) thin-bedded ripple cross-laminated sandstone as low-density turbidite. Based on core evidence of a sedimentary cross-section along flow direction with six cored wells, the most possible trigger of sediment gravity flow is delta-front collapse. Deltaic channelized sandstones are dominant in the proximal area. Sandy slumps are dominant in the middle area, which is formed by collapse of deltaic deposits and transform to high density turbidite and sandy debrite in the distal area. Few low-density turbidite is shown. With additional geochemical evidence showing relative water depth, it can be determined that the study area is in a transitional environment in lacustrine basin between marginal delta and distal basin plain. In addition, the porosity and permeability data indicate that different types of deposits have varying reservoir quality, especially for permeability. As a result, reservoir quality is not only affected by fault development degree. Distinguishing high-permeability sandstone is vital for oil-production in tight sandstone reservoirs. Therefore, this research sheds light on a new perspective based on delicate sedimentary research for future oil exploration and development in tight sandstone reservoirs in the most productive Ordos Basin.